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Abstract

Regional monetary and financial cooperation among the monetary authorities of Asian countries have been further strengthening through the recent global financial crisis in 2007-2008. Finance Ministers and Central Bank Governors of the ASEAN Members States, People's Republic of China (PRC), Japan and Korea (ASEAN plus three) and the monetary authority of Hong Kong, China announced that the Chiang Mai Initiative Multilateralization (CMIM) agreement came into effect on March 24, 2010. They also reached agreement on establishing a surveillance office, which is called an ASEAN plus three Macroeconomic Research Office (AMRO) and would ensure technical details of regional surveillance.

The regional monetary cooperation in Asia has been discussed for years. For example, Ogawa and Shimizu (2005) proposed both an Asian Monetary Unit (AMU), which is a common currency basket computed as a weighted average of the thirteen ASEAN plus three currencies, and AMU Deviation Indicators (AMU DIs), which indicates deviation of each Asian currency in terms of the AMU compared with the benchmark rate. The AMU and the AMU DIs are considered as both surveillance measures under the Chiang Mai Initiative and coordinated exchange rate policies among Asian countries.

In this paper, we show that monitoring the AMU and the AMU DIs plays an important role in the regional surveillance process under the CMIM. By using daily and monthly data of AMU and AMU DIs in the period between January 2000 to June 2010, which are available in a website of the Research Institute of Economy, Trade, and

Industry (RIETI), we examine their usefulness as a surveillance indicator. Our studies of AMU and AMU DIs confirm as follows: First, an AMU peg system stabilizes Nominal Effective Exchange Rate (NEER) of each Asian country. Second, the AMU and the AMU DIs could warn overvaluation or undervaluation for each of Asia currencies. Third, trade imbalances within the region have been growing as the AMU DIs have been widening. Forth, the AMU DIs could predict huge capital inflows and outflows for the Asian country. The above fact-findings support usefulness of using the AMU and the AMU DIs as surveillance indicators for monetary cooperation in Asia.

Keywords: regional monetary cooperation, common currency basket, Asian Monetary Unit

1. Introduction

The Regional monetary and financial cooperation among the monetary authorities of Asian countries have been further strengthening through the recent global financial crisis in 2007-2008. The Finance Ministers and Central Bank Governors of the ASEAN Members States, People's Republic of China (PRC), Japan and Korea (ASEAN plus three) and the monetary authority of Hong Kong, China announced that the Chiang Mai Initiative Multilateralization (CMIM) Agreement has come into effect on March 24, 2010. They also reached agreement on establishing a surveillance office in Singapore, which is called the ASEAN plus three Macroeconomic Research Office (AMRO). Financial Ministers of the ASEAN plus three now have to ensure that technical details are ironed out. The AMRO will monitor and analyze the regional economies, which will contribute to early detection of possible currency crises, swift implementation of remedial actions, and effective decision-making in the region.

The regional monetary cooperation in Asia has been discussed for years. It would be necessary not only for preventing possible currency crises in the future but also for keeping intra-regional capital flows and exchange rates stable. We should consider how we will promote the regional monetary cooperation. One way is to create a common currency basket (regional monetary unit, RMU) and use it for economic surveillance. A common currency basket system with a fluctuation band, which is similar to so-called "BBC rule" suggested by Williamson (2000), would be an effective way to detect exchange rate misalignment among Asian currencies.

Ogawa and Shimizu (2005) proposed both an Asian Monetary Unit (AMU),

which is a common currency basket computed as a weighted average of thirteen Asian currencies, and AMU deviation indicators (AMU DIs), which indicates deviation of each Asian currency in terms of the AMU compared with the benchmark rate[1]. The AMU and the AMU DIs are considered as both surveillance measures under the Chiang Mai Initiative and coordinated exchange rate policies among East Asian countries. In this paper, we show that monitoring the AMU and the AMU DIs plays an important role in the regional surveillance process under the CMIM. By using daily and monthly data of AMU and AMU DIs in the period between January 2000 to June 2010, which are available in a website of the Research Institute of Economy, Trade, and Industry (RIETI), we consider them from the following standpoints: First, how did the AMU related with three major currencies, the US dollar, the euro and the yen? Second, how could they stabilize a nominal effective exchange rate (NEER)? Third, how did they predict any currency crisis during the Asian currency crisis and during the recent 2007-2008 crisis?

The rest of this paper is organized as follows. Section 2 presents an overview of previous researches for a common currency basket proposal for Asian countries. Section 3 investigates the AMU and its relationship with the three major currencies. Section 4 focuses on comparison between a NEER calculated by the Bank for International Settlements (BIS) and a NEER under the hypothetical AMU peg system. The comparisons tell us how the AMU stabilizes NEER of Asian currencies. Section 5 investigates The AMU and the AMU DIs during the Asian currency crisis in 1997 and during the recent global financial crisis in 2007-2008. Finally, section 6 summarizes our analytical results and presents the conclusion.

[1] For details on AMU and AMU Deviation Indicators, see Appendix.

2. Related researches about a common currency basket in Asia

Some of Asian countries, which include Singapore and Malaysia (since July 2005), have adopted a currency system in line with a Basket, Band and Crawling (BBC) rule[2] after the Asian currency crisis. During the recent global financial crisis in 2007-2008, however, a number of Asian currencies depreciated sharply while the Japanese yen has been appreciating against the other Asian currencies. At the same time, the Chinese yuan has been kept stabilizing especially against the US dollar although the Chinese government announced to adopt a managed floating exchange rate system with reference to a currency basket. As a result, movements in intra-regional exchange rates among Asian currencies have changed dramatically. Such a large fluctuation of the intra-regional exchange rates is undesirable for the Asian economy where private sector has established production networks.

Since the Asian economy has *de facto* increasing interdependency in terms of intra-regional trade and foreign direct investments, it is indispensable to establish regional currency coordination in order to minimize exchange rate fluctuations or exchange rate risks in international trade and investments within the region. A proposed approach in this regard is to create a common currency basket, which will serve as an anchor for Asian currencies. Ogawa and Shimizu (2005) proposed the Asian Monetary Unit (AMU), which is computed as the weighted average of thirteen Asian currencies (ASEAN, People's Republic of China (PRC), Japan, and Republic of Korea). Moreover, we have developed AMU Deviation Indicators based on the AMU in order to serve them for surveillance over fluctuations and misalignments of intra-regional exchange rates

[2] The BBC rule was proposed by Williamson (2000).

under the Chiang Mai Initiative.[3] The AMU Deviation Indicators are employed as benchmarks for enabling the monetary authorities of the Asian countries to keep their regional coordination in exchange rate policies. The monetary authorities could ensure that each of Asian currencies does not so much deviate from a common currency basket or the AMU. This would enable the Asian countries to achieve stability of intra-regional exchange rates and float jointly against outside currencies which include the US dollar and euro. Ogawa and Shimizu (2007) proposed a step-wise approach for transitioning from an individual currency basket system to a common currency basket system in Asia as an indicative proposal.

There is another proposal to stabilize the intra-regional exchange rates among Asian currencies without depending on any common currency basket. For example, Ma and McCauley (2008) suggest that stability of intra-Asian exchange rates might build on similar national policies of stabilizing home currencies against their own respective currency baskets because of their similarities of trade-weighted currency basket. Similarly, Wyplosz and Park (2008) advocate adopting own currency basket peg vis-à-vis its non-regional trade partners, which would be enough to stabilize the exchange rate. Both of the papers indicate that effective exchange rates of Asian currencies can be stabilized without any further monetary cooperation. Shimizu and Ogawa (2009) obtain an analytical result that we have a strong relationships among NEER, the AMU and AMU Deviation Indicators even during the period of global financial crisis. It suggests that an individual basket system is appropriate for Asian countries at

[3] Such a unit has also been extensively discussed in East Asia, for example, in the ADB (Kuroda and Kawai, 2003). The data of AMU and AMU Deviation Indicators has been published on the website of RIETI (http://www.rieti.go.jp/users/amu/en/index.html) since September 2005.

the first stage of exchange rate policy coordination. In this sense, it seems that the above-mentioned proposals are not essentially different at least as the first step.

3. Decomposition of the AMU

Currency regimes that are adopted by Asian countries are different with each other and their choices are broad ranging from a hard peg (a currency board), a managed float (with reference to a currency basket) to a free float. In other word, Asian currencies' degree of linkage with the US dollar vary from very strong (under a hard peg to the US dollar), weak (under a soft peg to the US dollar) to no relationship (under a free float). The AMU also has some degree of linkage with the US dollar because it is composed of the thirteen Asian currencies. Movements in the AMU should reflect the choice of currency regime in the region.

Following the methods of Frankel and Wei (1994), we identify estimated coefficients on the US dollar, the euro and the Japanese yen for the AMU to investigate how strong linkages the AMU has the three major currencies. We use daily data of exchange rates to estimate the following regression equation for each year of full sample period from 2000 to 2010.[4]

$$\dot{e}_{AMU/Sfr} = c_o + c_1 \cdot \dot{e}_{USD/Sfr} + c_2 \cdot \dot{e}_{Euro/Sfr} + c_3 \cdot \dot{e}_{Yen/Sfr}$$

If Asian countries actually shift their currency regimes from the strict or *de fatco* US dollar peg system to an individual currency basket system, the AMU's linkage with the US dollar becomes weaker and at the same time its relationship with the euro becomes

[4] In the sample of 2010, we use daily data from Jan 4 to June 30, 2010. The data of foreign exchange rate vis-à-vis the AMU are from RIETI and Datastream.

stronger. Since the Japanese yen is one of the composition currencies of the AMU, a coefficient on the Japanese yen should be the same as a weight of the Japanese yen in the AMU. However, if an estimated coefficient is smaller than the basket weight, it means that the monetary authorities of the other Asian countries conduct an exchange rate policy without caring about any stability against the Japanese yen. In this regards, linkages of the AMU with the three major currencies reflects currency regime or exchange rate policy adopted by the monetary authorities of the Asian countries.

Table 1 summarizes the analytical results of the regression. Figure 1 plots movements in the estimated coefficients of the three major currencies year by year. In the sub-sample periods from 2000 to 2005, coefficients on the US dollar decreased from 70% to 58%. On one hand, coefficients on the Japanese yen increased from 32% to 37%. Coefficients on the euro became significant in 2003 and 2004 even though they are just about 5%. The analytical results indicate that the Asian countries shifted from the US dollar peg system to an individual basket peg system.

However, in the sub-sample periods from 2006 to 2009, coefficients on the US dollar and the euro increased from 63% to 68% and from 8% to 15 % in 2008, respectively. In contrast, coefficients on the Japanese yen decreased from 31% to 21%. The analytical results indicate that Asian countries shifted back to a pro-US dollar foreign exchange rate policy or a US dollar peg system again. Comparison with estimated coefficients on the Japanese yen and its basket weight in the AMU shows that the former (37.63) was larger than the later (27.80) in 2005. However the former (21.23) was smaller than the latter (26.44) in 2010. The analytical results suggest that the monetary authorities of the other Asian countries shifted from a pro-Japanese yen

foreign exchange rate policy to a pro-US dollar exchange rate policy recently.[5]

Adopting own individual currency basket peg system would contribute to stabilization of the intra-regional foreign exchange rates among the Asian currencies in the future as the related researches in the previous suggested. However, their current exchange rate policy is still far from an individual currency basket system in spite that the monetary authorities should target not heavily the US dollar but a currency basket. This is why we need to use some common indicators, such as the AMU and the AMU Deviation Indicators, for surveillance over intra-regional exchange rates.

4. How could the AMU stabilize effective exchange rates?

There are some previous researches which investigate stabilization effects of a common currency basket peg system on effective exchange rates of the Asian currencies. For example, Williamson (2005) investigated whether use of a common currency basket would provide adequate stability of effective exchange rate of the participating country currencies. He supposed two exchange rate systems, which include an individual currency basket peg system and a common G3 currency basket peg system. He showed that the latter system could relatively stabilize NEERs of Asian currencies compared with the former system. Similarly, Ogawa and Shimizu (2006) simulated how NEERs would have moved under alternative exchange rate systems which include an individual currency basket system, a G3 common currency basket system and an AMU peg system by using data of exchange rates of Asian currencies vis-à-vis the AMU during a sample period from 2000 to 2004. They obtained an

[5] Given the strong linkage of the Chinese yuan with the US dollar, it can be interpreted that Asian countries shifted to a pro-Chinese yuan exchange rate policy.

analytical result that the AMU peg system stabilizes the NEERs more effectively for Indonesia, the Philippines, Republic of Korea, and Thailand than the other peg systems.

In this paper, we extend the sample period from January 2005 and June 2010 to investigate the stabilization effects of the AMU peg system on NEERs of East Asian currencies while we base on Ogawa and Shimizu (2006). Specifically, we compare standard deviations of NEERs under a hypothetical AMU peg system with those of NEERs that are calculated by the BIS (2005=100). Exchange rates of the Asian currencies in terms of the AMU, which are standardized as 100 in January 2005, are used to simulate NEERs under the hypothetical AMU peg system. Basket weights on each currency of NEER are same as those of NEERs that are calculated by the BIS.

Table 2 summarizes the analytical results. Standard deviations of the NEERs under the hypothetical AMU peg system are lower than those of actual (historical) NEER calculated by the BIS. Accordingly, we obtain an analytical result that the AMU peg system stabilizes the NEER of Asian currencies even during the global financial crisis. We also find that differentials in the standard deviations between actual NEERs and AMU-peg NEERs vary by country. For example, in the case of Singapore, the standard deviation of NEER calculated by the BIS was 3.728 while that of NEER under the hypothetical AMU peg system was 2.321. Similarly, in the case of Malaysia, the standard deviation of NEER calculated by the BIS was 2.699 while that of NEER under the hypothetical AMU peg system was 1.677. Thus, the differences are small in the case of Singapore and Malaysia that adopt a managed floating exchange rate system with reference to a currency basket. On the other hand, in the case of Republic of Korea that adopts free floating exchange rate system, the standard deviation of NEER calculated by the BIS was 13.038 while that of NEER under the hypothetical AMU peg system was

1.160. Similarly, in the case of Indonesia, the standard deviation of NEER calculated by the BIS was 7.785 while that of NEER under the hypothetical AMU peg system was 1.630. The results indicate that the NEER of free floating currencies would become dramatically more stable if the monetary authorities adopt an AMU peg system.

Figure 2 plots movements in the above two kinds of NEER as well as a nominal exchange rate in terms of the US dollar for reference in a period between January 2005 and June 2010 by country. In the case of People's Republic of China (PRC), an actual NEER calculated by the BIS appreciated more than 10 % during the global financial crisis (2007-2008) although a nominal exchange rate of the Chinese yuan in terms of the US dollar was kept very stable. If the monetary authority of People's Republic of China (PRC) adopted the AMU peg system in the same period, the Chinese yuan would appreciate less than half in terms of the NEER. In the case of Republic of Korea, both the actual NEER calculated by the BIS and the nominal exchange rate of the Korean won in terms of the US dollar depreciated more than 30% during the global financial crisis. If the monetary authority of Republic of Korea adopted the AMU peg system in the same period, their NEER would be kept very stable. The analytical results suggest that the AMU peg system would stabilize the NEER of Asian currencies even during the global financial crisis.

5. AMU and AMU Deviation Indicators during the Crises

Our researches use the AMU and the AMU Deviation Indicators (DIs) to conduct macro-economic analysis for surveillance purposes. In this section, we have a particular focus on the Asian currency crisis in 1997 and the recent global financial crisis

in 2007-2008. We investigate how accurately The AMU and the AMU DIs showed crisis situation during the two crises.

5-1. AMU during the Asian currency crisis in 1997

At first, we retroact both the AMU and the AMU DIs in the period around the Asian currency crisis in 1997 before the benchmark period 2000-2001[6]. Figure 3 shows the movements of the AMU in terms of the US dollar, the euro (weighted average of European currencies before January 1999) and the US$-euro basket currency from January 1995 to the end of 2000. In 1996, exchange rate of the AMU in terms of the euro was at around 1.0 while the exchange rate in terms of the US dollar was larger than 1.2, given that the benchmark period for the exchange rates was 2000-2001.. It means that the AMU was more than 20 percent overvalued vis-à-vis the US dollar compared with the AMU benchmark year (2000-2001) in the period before the Asian crisis.

Figure 4 shows movements in AMU DIs of some Asian currencies before and after the Asian currency crisis. It is clear that AMU DIs of crisis-hit currencies were overvalued before the Asian currency crisis. Particularly, an AMU DI of the Indonesian rupiah had the largest overvaluation among the Asian currencies (Figure 4-(a)). Figure 4-(b) shows that AMU DIs of the Thai baht and the Malaysian ringgit were also more than 20 % overvalued. On one hand, an AMU DI of the Korean won was below 10 % overvalued when the Thai baht started to collapse in July 1997. After then, it climbed gradually up to 17% of overvaluation. It started to depreciate sharply to almost minus

[6] For the calculation of the AMU and AMU DIs backward in 1990s, we use the simulated euro before the introduction of the euro.

40% of undervaluation in December 1997. Thus, the movements in the AMU DIs showed an exact scenario of currency crisis contagion from Thailand to Republic of Korea. In contrast, AMU DIs of the Singapore dollar, the Chinese yuan and the Japanese yen were undervalued before the Asian currency crisis. Especially, those of the Chinese yuan and the Japanese yen were below minus 20 of undervaluation, which means that the crisis-hit currencies were more than 40 % overvalued compared with the two major Asian currencies.

When we watch movements in both The AMU and the AMU DIs during the Asian currency crisis, we can find that the AMU was more than 20 percent overvalued vis-à-vis the US dollar and the crisis-hit currencies were more than 40 % overvalued compared with the Chinese yuan and the Japanese yen. These results suggest that the monetary authority should monitor The AMU and the AMU DIs to find any signs for predicting a currency crisis in the near future.

5-2. AMU during the recent global financial crisis in 2007-2008

Some of Asian currencies have been depreciating against the US dollar as a result of the sell-off of local currencies accompanying the capital outflows related with deleveraging by US and European financial institutions since 2007. It dramatically happened since the Lehman shock on September 15, 2008. The only exception was the Japanese yen, which has appreciated substantially against the US dollar. The Chinese yuan has been kept relatively stable vis-à-vis the US dollar by the Chinese monetary authority's heavy intervention in foreign exchange market even during the global financial period. The Singapore dollar and the Malaysia ringgit also have not so much

depreciated against the US dollar because the monetary authorities has kept a currency basket system. In contrast, the Korean won has had much larger depreciation than any other Asian currency. The Thai baht and the Indonesian rupiah also have depreciated due to the sub-prime mortgage problem and fallout from the Lehman Brothers' demise.

Figure 5 shows movements in AMU DIs from January 2000 to March 2010. It is clear that the Asian currencies have been widening in terms of increasing weighted averages of AMU DIs as Ogawa and Yoshimi (2008) pointed out. The increasing weighted averages of AMU DIs might reflect in regional trade imbalances in some extents since the benchmark period to calculate AMU DIs is set as the period when total trade balances (intra-regional trade balances) of the Asian countries was the closest to zero., Figure 6 shows movements in trade balances within the region by country from 1st quarter of 2000 to 4th quarter of 2009. Trade imbalances within the region have been growing as the weighted average of AMU DIs was increasing. Especially, a large surplus trend of regional trade balance suddenly turned to a large deficit once the subprime crisis happened in the 3rd quarter of 2008. The fact-findings suggest us that sudden and volatile movements in the AMU DIs have negative impacts on the intra-regional trades among the Asian countries.

The volatile movements in the AMU DIs also might be caused by erratic capital flows. Suppose that we set a plus/minus 15％ of fluctuation band of AMU DIs where plus/minus 15％ of fluctuation band is the same as the fluctuation band in Exchange Rate Mechanism (ERM) II in the EU. Figure 5 shows that most of the Asian currencies except for the Philippine peso were kept within the band during a period from 2000 to 2005. Since 2006, however, an AMU DI of the Korean won started to rise beyond the upper band of 15% while the Thai baht and the Singapore dollar followed this upward

trend. In contrast, an AMU DI of the Japanese yen was undervalued.

What caused the currencies to deviate from their benchmark level? One possible answer is a carry trade between the Japanese yen and other currencies. The Japanese yen was highly involved into carry trade strategies as a funding currency because of their continuing extremely low interest rates in 2000's[7]. Higher interest rates for other Asian currencies which include the Korean won and the Thai baht were no exception as an investing currency of yen related carry trade. As Gyntelberg (2009) indicates that net purchases of Thai equities by non-resident investors lead to appreciation of the Thai baht in 2007, the movements in capital flows is one of the important factors to destabilize the intra-regional exchange rate[8].

In the rest of this section, we investigate relationships between the AMU DIs and capital flows. We focus on three volatile Asian currencies which include the Korean won, the Indonesian rupiah and the Thailand baht to compare their AMU DIs and capital flows, especially "Other Investments" in the balance of payments by using data from the *International Financial Statistics*, IMF. Figure 7 shows relationships between the AMU DIs and the "Other Investments" for the three countries.

In the case of Korea, the AMU DI went up gradually from the middle of 2004 and was kept above 15% during a period from the 2nd quarter of 2006 to 4th quarter of 2007. In this period, Korea had large capital inflows at a liability side of "Other Investments". In the 3rd quarter of 2008, the AMU DI of the Korean won sharply went down below minus 15 % of undervaluation. At the same time, large capital outflows

[7] Hottori and Shin (2007) confirmed that the volumes of carry trade involving the yen were high when interest differential against the yen were high.

[8] Plantin and Shin (2006) express that a high-yield currency will go "up by the stairs" and come "down with the elevator".

occurred at both a liability and asset side of "Other Investment".

In the case of Indonesia, large capital outflows occurred at an asset side of "Other Investments" in the 3rd quarter of 2008 while the AMU DI of the Indonesian rupiah went down below 15 % of undervaluation.

The case of Thailand is different from the formers. When the AMU DI of the Thai baht climbed up above 15% of overvaluation during a period from the 1st quarter of 2007 to the 1st quarter of 2008, Thailand had no large capital inflows except in the 1st quarter of 2008. It is because the capital controls which was suddenly introduced by the Bank of Thailand in December 2006 and eliminated on March 3, 2008. Actually, the Thai baht did not sharply depreciate like the other two currencies during the recent global financial crisis 2007-2008.

These fact-findings indicate that the AMU DI's reach to an upper band, for example plus 15% of fluctuation band, could alert the excess capital inflows that might cause capital outflows afterward. Thus, monitoring the AMU DIs is useful to predict the excess capital inflow/outflow of the country.

6. Conclusion

In this paper, we showed that monitoring the AMU and the AMU DIs plays an important role in the regional surveillance process in Asia. Daily and monthly data of AMU and AMU DIs are used to make surveillance over intra-regional exchange rates among the Asian currencies. Our investigation of the AMU and the AMU DIs showed the following fact-findings: First, the AMU peg system stabilizes NEERs of East Asian currencies. Second, the AMU and the AMU DIs during the period just before the Asian

currency crisis in 1997 shows that a weighted average of the Asian currencies was overvalued against the US dollar while the currencies of crisis-hit countries also were overvalued against the other Asian currencies. Thus, both the AMU and the AMU DIs could alert the overvaluation of the Asian currencies before the Asian currency crisis. Third, trade imbalances within the region were growing as the AMU DIs were widening among the Asian currencies. Forth, the AMU DIs could predict the excess capital inflows into the countries and capital outflows from the countries. The fact-findings support the usefulness of using both the AMU and the AMU DIs as a surveillance indicator for monetary cooperation in Asia.

A practical way to utilize the AMU DI as a surveillance indicator will be discussed continuously as a future issue. For example, how to decide a fluctuation band of the AMU DI is an important issue. In order to decide the fluctuation band, we need to analyze the relationship between interest differentials and capital inflows/outflows. This paper focused on the AMU and the AMU DIs only in terms of nominal exchange rates. The nominal AMU and AMU DIs are suit for daily surveillance over nominal exchange rates and capital inflows/outflows while we need to use The AMU and the AMU DI in terms of real exchange rates for macroeconomic surveillances over exports imports, and trade balances as well as foreign direct investments. These remain issues to be considered in future.

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Appendix: The AMU and AMU Deviation Indicator

i. Calculating the AMU

We calculated the AMU according to the approach employed for calculating the European Currency Unit (ECU) under the EMS before the introduction of the euro in 1999. Just as the ECU was defined as a basket of currencies of member countries of the European Union (EU), the AMU has been defined as a basket of currencies of the ASEAN 10+3 countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, Japan, People's Republic of China (PRC), and Republic of Korea). The weight assigned to each currency in this basket is based on the share of GDP measured at Purchasing Power Parity (PPP), and overall trade volumes (the sum of exports and imports) of each sample country. We calculated the share of GDP measured at PPP and trade volumes for each country using the average of the last three years in order to arrive at the currency shares of the AMU (the current version is based on 2005-2007).

Since both the United States and EU countries are important trading partners for East Asia, the AMU is quoted in terms of a weighted average of the US dollar and euro. The weighted average of the US dollar and the euro (hereafter, US$-euro) is based on the trade volumes of East Asian countries with the United States and EU. The weights assigned to the US dollar and euro were 65% and 35%, respectively.

Subsequently, a benchmark period in order to calculate AMU Deviation Indicators was determined. The benchmark period was defined in the following manner. The total trade balance of member countries (intra-regional trade balance), total trade

balance of the member countries (excluding Japan) with Japan, and total trade balance of member countries with the rest of world must be approximately zero. Consequently, it was found that the trade balance in 2001 was the closest to zero. Assuming a one-year time lag before changes in exchange rates affect trade volumes, we chose 2000 and 2001 as the benchmark period. For the benchmark period, the exchange rate of the AMU in terms of the US$-euro was set at unity. We defined the exchange rate of each East Asian currency in terms of the AMU during the benchmark period as the benchmark exchange rate.

Overall, the AMU weights were calculated based on both the arithmetic share of trade volumes and GDP measured at PPP. The table below indicates the AMU basket weights and benchmark exchange rates.

— AMU Basket Weights of East Asian Currencies —

(revised in 10/2010****, benchmark year=2000/2001)

	Trade volume* %	GDP measured at PPP**,%	Arithmetic average shares % (a)	Benchmark exchange rate*** (b)	AMU weights (a)/(b)
Brunei	0.35	0.13	0.24	0.589114	0.0041
Cambodia	0.21	0.17	0.19	0.000270	6.9779
China	26.48	46.65	36.57	0.125109	2.9228
Indonesia	5.68	5.54	5.61	0.000113	497.9163
Japan	22.40	28.15	25.28	0.009065	27.8842
South Korea	13.03	8.27	10.65	0.000859	123.9422
Laos	0.13	0.08	0.10	0.000136	7.5226
Malaysia	7.37	2.36	4.87	0.272534	0.1786
Myanmar	0.37	0.37	0.37	0.159215	0.0232
Philippines	2.22	1.95	2.09	0.021903	0.9527
Singapore	12.74	1.48	7.11	0.589160	0.1207
Thailand	6.54	3.41	4.98	0.024543	2.0272
Vietnam	2.48	1.44	1.96	0.000072	273.9808

* : The trade volume is calculated as the average of total export and import volumes in 2006, 2007 and 2008 taken from DOTS (IMF).

**: GDP measured at PPP is the average of GDP measured at PPP in 2006, 2007 and 2008 taken from the World Development Report, World Bank. For Myanmar's share of GDP measured at PPP, we use the sahre of Trade volume because of the data constraint.

*** : The Benchmark exchange rate ($-euro/Currency) is the average of the daily exchange rate in terms of US$-euro in 2000 and 2001.

**** : AMU shares and weights were reviced in Oct. 2010. This is the 6th version.

Source: RIETI (http://www.rieti.go.jp/users/amu/en/index.html)

ii. Calculating the AMU Deviation Indicator

The nominal exchange rate of each East Asian currency in terms of the AMU is used in order to determine its AMU Deviation Indicator. The AMU Deviation Indicator signifies the deviation of each East Asian currency from the benchmark exchange rate, vis-à-vis the AMU and is represented by a formula in the following manner:

$$\text{AMU Deviation Indicator (\%)} = \frac{\text{actual exchange rate of } \text{AMU}/\text{a currency} - \text{benchmark exchange rate of } \text{AMU}/\text{a currency}}{\text{benchmark exchange rate of } \text{AMU}/\text{a currency}} \times 100.$$

When the AMU deviation indicator of say, currency A is positive, it implies that the

currency A's actual exchange rate vis-à-vis the AMU is higher than its benchmark exchange rate vis-à-vis the AMU (this represents an appreciation of currency A against the AMU). Similarly, when the AMU deviation indicator of say, currency A is negative, it implies that the currency A's actual exchange rate vis-à-vis the AMU is lower than its benchmark exchange rate vis-à-vis the AMU (this represents a depreciation of currency A against the AMU).

Table 1. AMU de-composition with three major currencies

Dependent Variable: AMU/SFR
Method: Least Squares

Variable	2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010	
Constant	0.0002		0.0000		0.0000		0.0000		0.0000		-0.0001		-0.0002		-0.0001		0.0000		-0.0001		-0.0002	
US dollar	0.7046	***	0.7080	***	0.6496	***	0.6511	***	0.6302	***	0.5844	***	0.6361	***	0.6754	***	0.6865	***	0.6472	***	0.6808	***
Euro	0.0153		-0.0106		-0.0321		0.0509	**	0.0516	**	0.0408		0.0830	*	0.1499	***	0.1544	***	0.1210	***	0.0996	***
Japanese yen	0.3219	***	0.3267	***	0.3177	***	0.3298	***	0.3462	***	0.3763	***	0.3109	***	0.2238	***	0.2254	***	0.2584	***	0.2123	***
Adj. R-squared	0.9812		0.9793		0.9691		0.9814		0.9911		0.9719		0.9577		0.9458		0.9528		0.9737		0.9429	

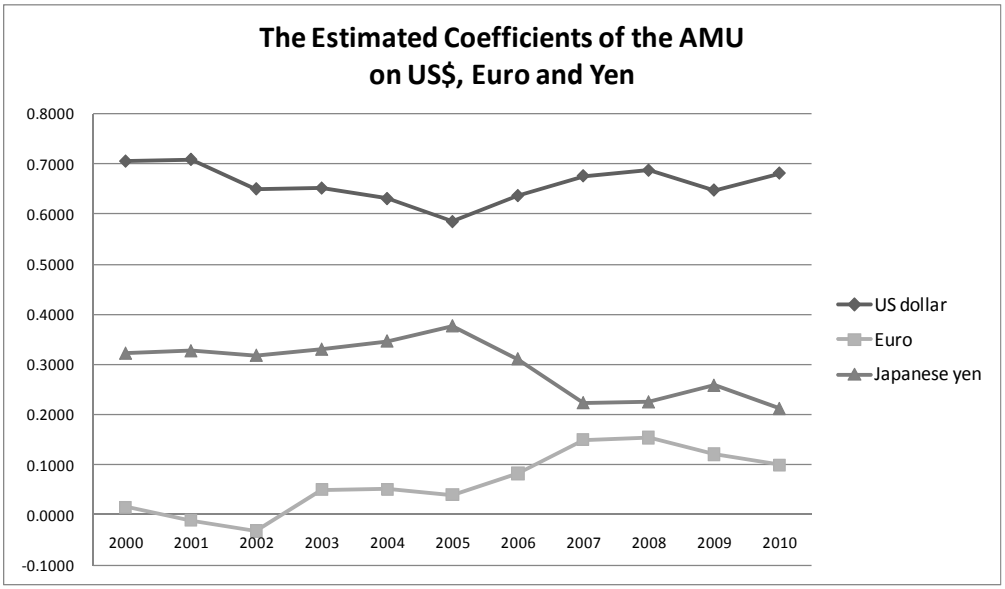
Autuors' calculation.
Source: The Data of foreign exchange rate vis-à-vis the AMU are from RIETI and Datastream.
Note: *** significant at 1% level ** sigunificant at 5% level * significant at 10% level

Table 2. The standard deviation of NEER (BIS) and NEER simulated under AMU peg system, (Monthly data, January 2005 to June 2010)

Country	NEER (BIS) (1)	NEER simulated under the AMU peg system (2)
People's Republic of China (PRC)	8.280	2.715
Indonesia	7.785	1.630
Japan	7.968	2.773
Republic of Korea	13.038	1.160
Malaysia	2.699	1.677
Philippines	10.148	1.486
Singapore	3.728	2.321
Thailand	5.900	1.334

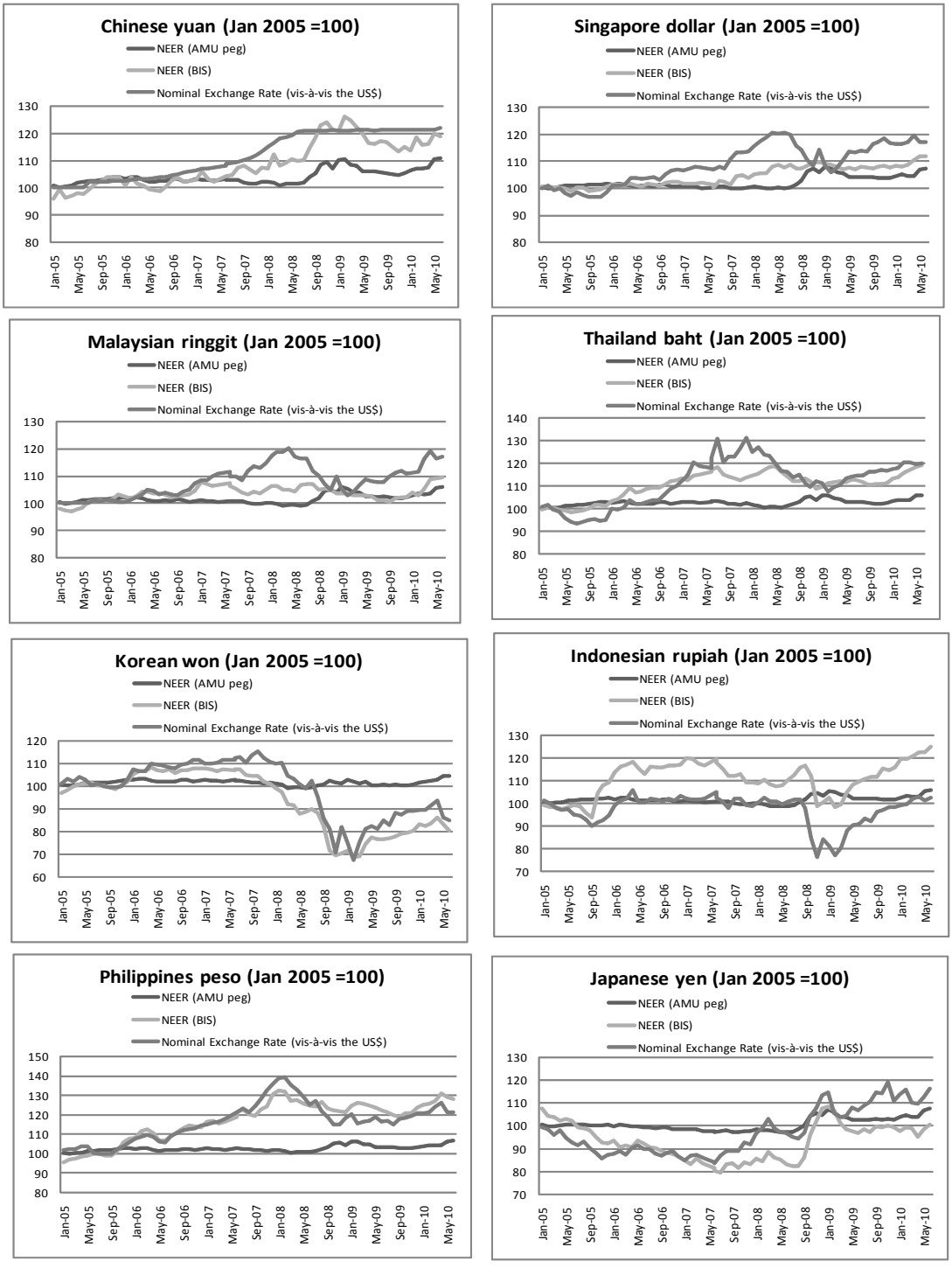
Author's calculation
(1) Standard deviations of month end nominal effective exchange rates calculated by BIS. (January 2005=100).
(2) Nominal effective exchange rates (NEER) under the hypothetical AMU peg system are simulated by using each exchange rate vis-a-vis the AMU which is standardized 100 in January 2005. The basket weights of NEER are same as those of NEER calculated by BIS.

Figure 1. The Estimated Coefficients of the AMU on US$, Euro and Yen



(Authors' calculation)

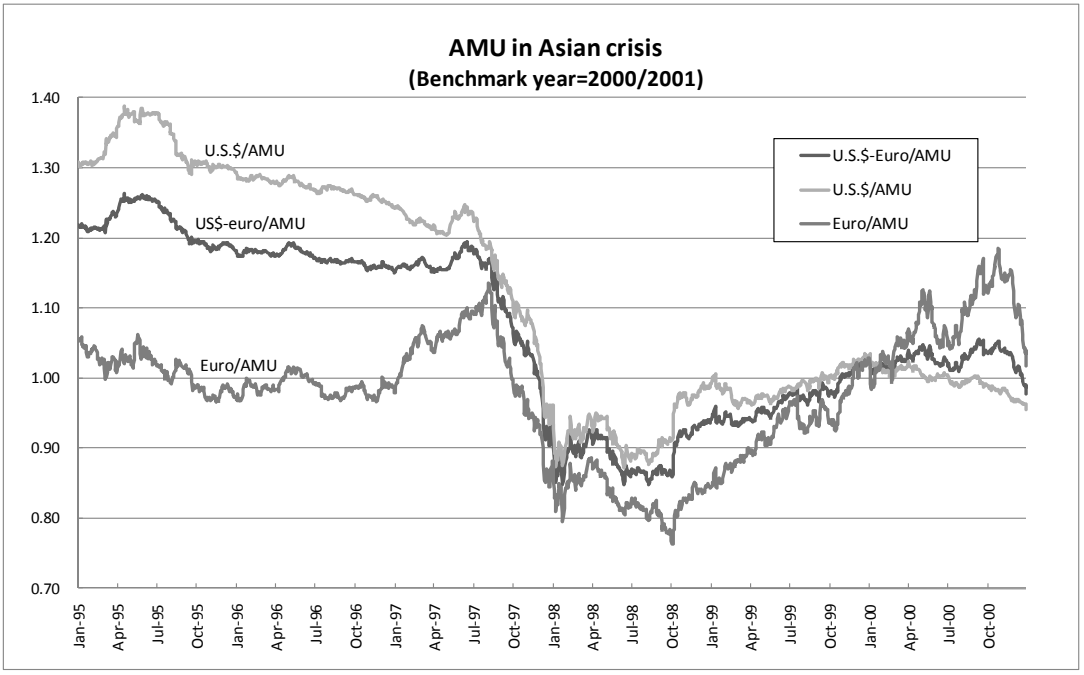
Figure 2. The movements of NEERs and Nominal exchange rate vis-à-vis the US dollar



(Authors' calculation)

Note: AMU exchange rates are downloaded from RIETI. NEER (BIS) are downloaded from BIS. Nominal exchange rates are downloaded from Datastream.

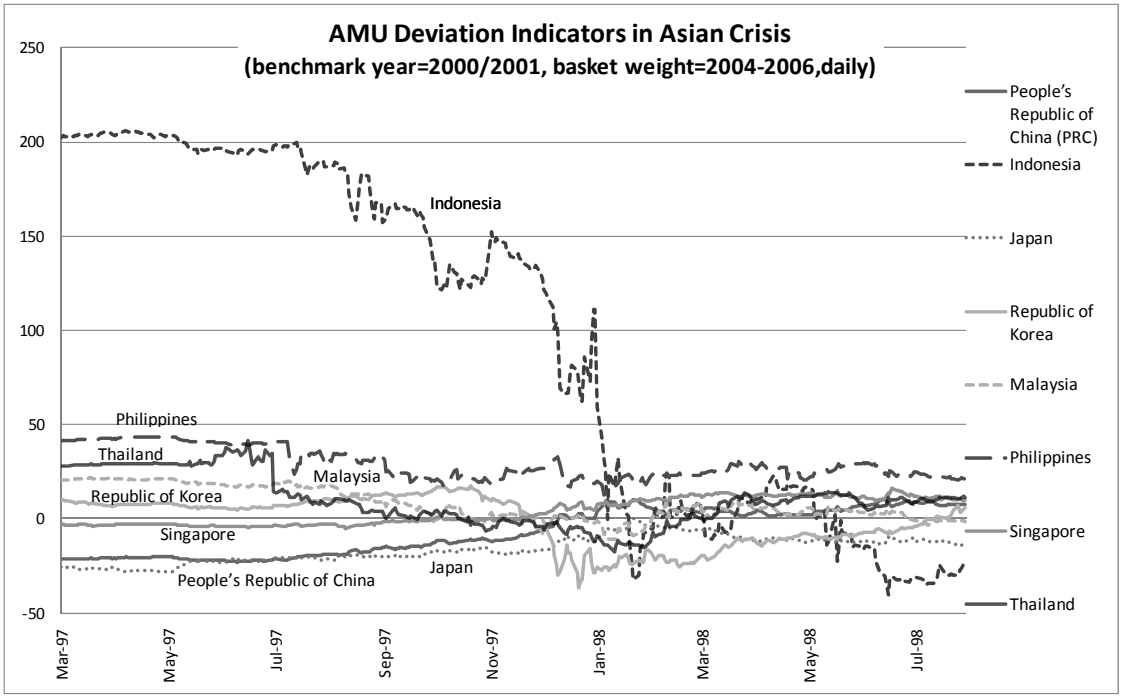
Figure 3. The AMU in Asian Crisis (January 1995 to December 2000)



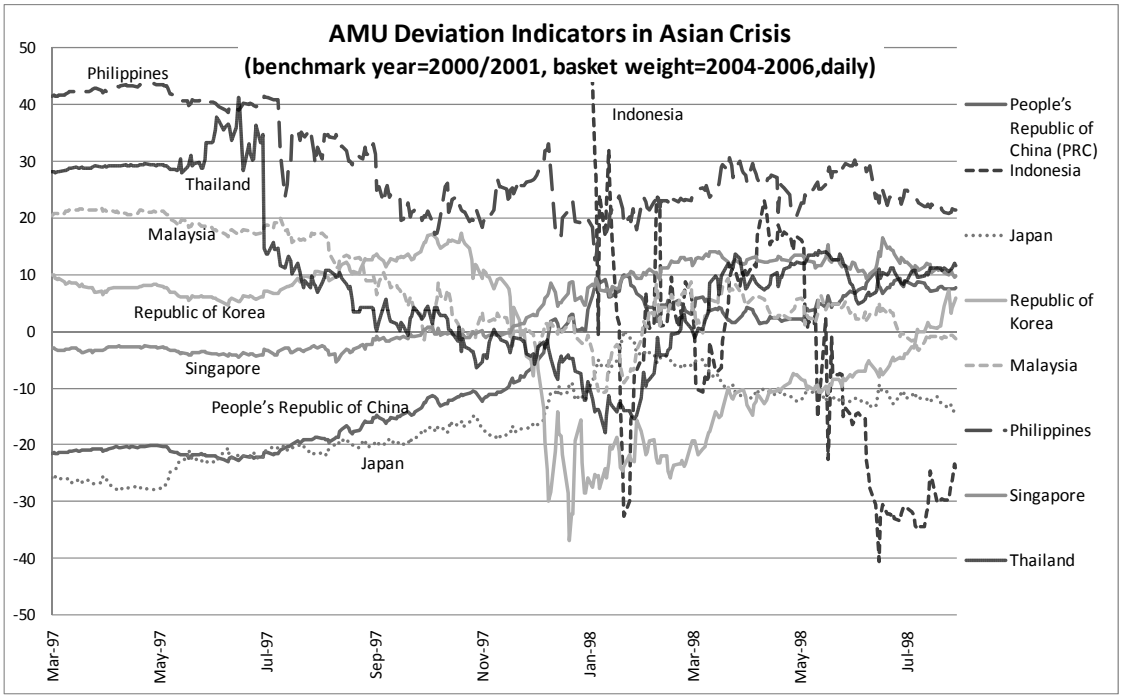
(Authors' calculation)

Figure 4. The AMU Deviation Indicators in Asian Crisis (March 1997 to December 1998)

(a) With Indonesia

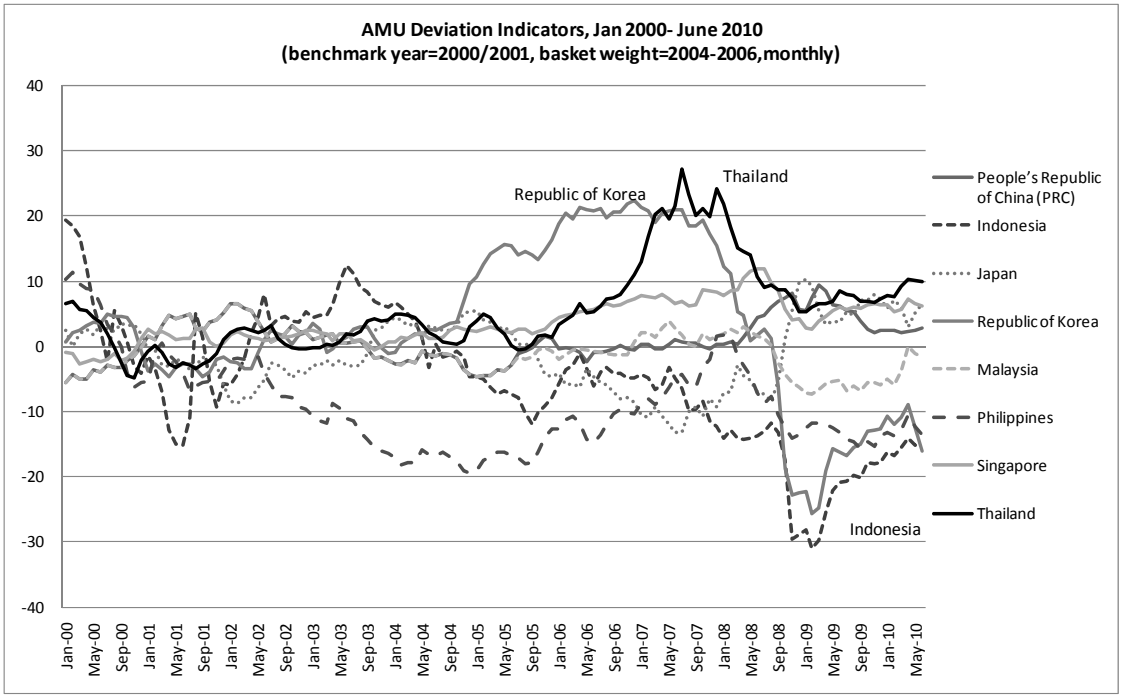


(b) Without Indonesia



(Authors' calculation)

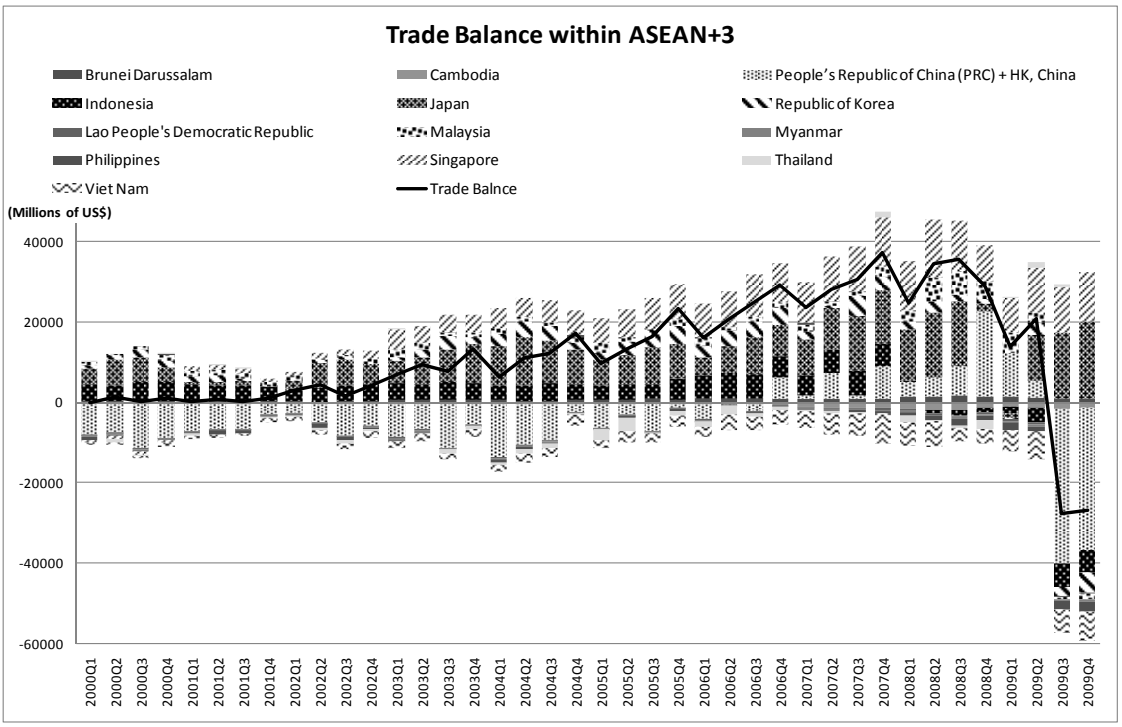
Figure 5. The AMU Deviation Indicator (January 2000 to June 2010)



Source: RIETI (http://www.rieti.go.jp/users/amu/en/index.html)

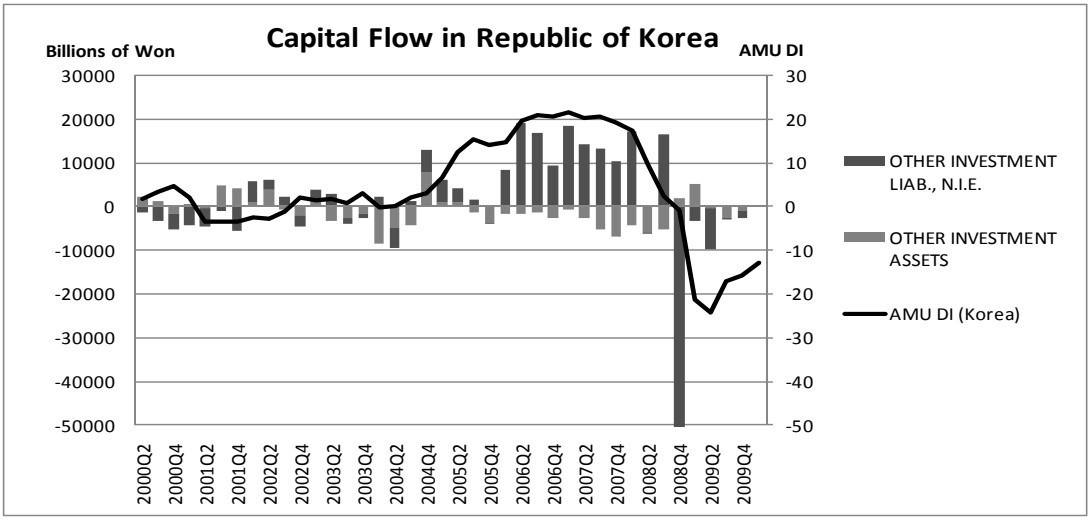
Figure 6. The Trade Balance with ASEAN, Japan, Republic of Korea,

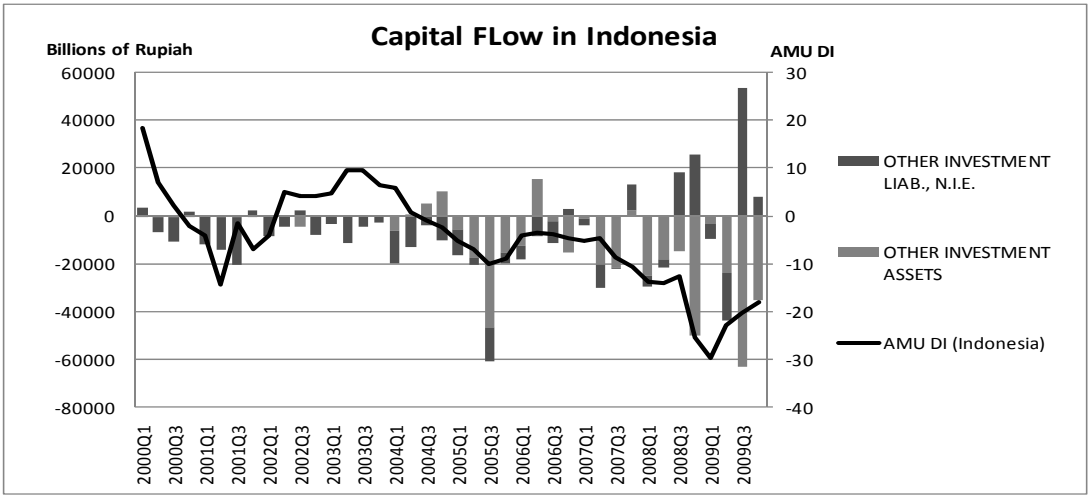
and People's Republic of China (PRC), (1Q 2000 to 4Q 2009)

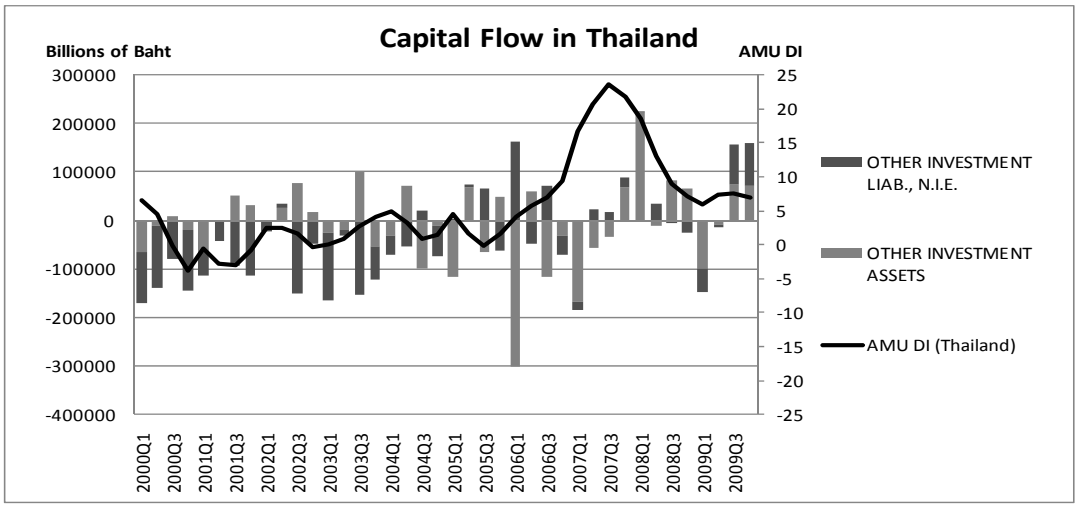


Source: Direction of Trade Statistics, IMF.

Figure 7. Capital Flow and the AMU DI







Source: Data of capital flow are from IFS (IMF). Data of AMU DIs are from RIETI.